

NEWS

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effective work by scientists at the National

TEKTITE DISCOVERY

Ten years of detective work by scientists at the National Aeronautics and Space Administration's Ames Research Center, Mountain View, Calif., has produced major new evidence that from 10 to 100 million tons of the Moon is almost certainly already on Earth.

The last shower of this lunar material, called "tektites," arrived some 700,000 years ago, sprayed from the Moon's surface by the impact of a meteorite the size of a small mountain, which formed the 56-mile-wide, nine-mile-deep lunar crater Tycho.

Millions of tons of this lunar splash traveled 240,000 miles through space for about three days and showered down on the Earth, mainly over Australia, the Philippines and southeast Asia.

Tektites are chunks of glass that were first fused by the heat of meteorite impact and then reshaped by aerodynamic ablation during entry into the Earth's atmosphere from space.

In the process of fusing into glass, the valuable record of what minerals composed this lunar rock was largely obliterated. Although the tektites are not a substitute for the complete mineralogical record contained in the rock samples brought back by the astronauts, they are providing scientists with much new knowledge about the chemistry of the lunar crust. During the past decade, Dr. Chapman at Ames, has assembled several tons of tektites.

The cosmic event which created the tektites, a collision with the Moon by a three-mile-diameter, projectile, of iron-nickel composition, undoubtedly produced major luminous phenomena bright enough to be visible from Earth.

Reflection of sunlight from billions of glass objects diffused through space would have presented a light spectacle in the sky for many nights. To this was added a half-day-long rumble of continuous sonic booms as the tektites arrived and entered the atmosphere. Thick-browed Java man, whose fossil bones have been found with tektites, undoubtedly witnessed this extraordinary celestial event.

Scientists have differed concerning the origin of tektites since their discovery over a century ago. However, recent findings appear to clinch the Moon as the source.

Dr. Dean R. Chapman, Chief of the Thermo-and Gas-Dynamics Division at Ames Research Center, a world authority on tektites, has been working on them since 1959. Recently he has been able to relate the chemical composition of one family of Australasian tektites to the chemical composition of the rock on Tycho's rim, as determined by Surveyor VII when it landed there in 1968.

Dr. Chapman also has identified the exact lunar source of the Australasian tektite shower. It is a ray of ejected rock, the "Rosse ray," which can easily be seen on the lunar surface, projecting out from the huge crater Tycho for a thousand kilometers in the direction of 19° north of lunar east, and passing over the smaller crater Rosse.

By screening a million tektites, and chemically analyzing a select 600 of them from 200 different discovery sites, he has charted their precise landing pattern as an inclined "S" spread over the Earth's surface. Thousands of computer trajectory runs have proved that only a shower of objects originating at Tycho and traveling in the same direction as the Rosse ray could have produced this particular pattern on Earth.

These conclusions throw light on the Moon's history and allow dating of certain lunar surface features. Since the Australasian tektites are an estimated 700,000 years old, so is Tycho. Material on the Moon that is overlain by rock ejected from Tycho is older.

At least three cosmic impacts have showered the Earth with lunar debris: one - 35-million years ago landing in the United States; another, 15-million years ago landing in Czechoslovakia; and the 700,000 year-old Australasian tektites.

Dr. Chapman, who saw his first tektites in 1959 in the British Museum, recognized that it must have entered the Earth's atmosphere from space. He had made nearly identical objects in an Ames wind tunnel during numerous simulations of atmosphere entry.

The tektites cannot have come from a wandering cloud of meteoroids because they lack the isotope aluminum 26 which is produced by cosmic ray bombardment during long times in space. Moreover, a meteorite impact is known to have melted the rock that formed the tektites, since numerous meteorite fragments have been discovered encased in the tektites by Dr. E. Chao of the U. S. Geological Survey. These two bits of evidence established the origin as a large meteorite impact crater, either on Earth or the Moon. No crater of sufficient size, and of the proper age, and location is known on Earth. Also, there is no radial wheel-spoke-like pattern of tektite landings, leading back to a specific impact point on Earth.

Ring waves on the tektite, due to atmosphere entry, show that they had the required arrival speed of 25,000 mph for objects coming from the Moon.

The inclined-S landing pattern of the Australasian tektites runs from near Madagascar to south of Tasmania, then northwest across Australia, curving north across Indonesia, then northeast over southeast Asia and the Philippines. As a source of tektites each crater on the Moon would produce a different landing pattern on Earth due to the curving trajectories from Moon to Earth, combined with the rotation of the Earth about an inclined axis. It was Chapman's research on these curving trajectories that established the Rosse ray from Tycho as the source of the Australasian tektites.

Dr. Chapman points out that, although the tektites are a good heat-shield material and do not disintegrate during atmosphere entry, other chemical types of lunar rock may also have splashed out from Tycho but not survived atmosphere entry.